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sea temperatures were useful in their way. He had adapted an instrument for the purpose, made of bamboo and furnished with two valves. He tried it one voyage and got some satisfactory results, which are now lodged in the Meteorological Department of the Board of Trade.

Captain DAVIS explained that he had not the slightest intention of detracting from the value of Captain Toynbee's observations. Indeed they were invaluable, simply on account of their having been taken so many times in the same place. He was perfectly aware of the difference of temperature at different seasons of the year, because he had studied Captain Maury's charts well. The whole of the seamen of Great Britain could only be thankful to Captain Toynbee for the trouble he had taken. If every commander of a vessel would take observations in the same way, we should soon be able to construct a physical chart of the sea.

The next Paper was the following—

2. *Ascent of the Rovuma, East Africa.* By J. KIRK, Esq., M.D., F.R.G.S.

THE ROVUMA, although a stream of small dimensions compared with the larger rivers which drain the African continent, is yet of considerable interest in a geographical point of view, as the first of importance on 600 miles of coast north of the Zambesi, and opposite that blank on the map where the great problem in African geography remains to be solved, and the head waters of the Congo, the Nile, and the Zambesi yet to be defined. The Tanganyika lake, which lies in this space, finds advocates who drain its surplus waters north, south, east, and west; nor are we even sure that it possesses an outlet.

The Rovuma is an open path by which to settle this mystery, and lead the explorer safely beyond the extortionate tribes and jealous Arabs of the coast. This river opens to the Indian Ocean north of Cape Delgado, within the jurisdiction of the Sultan of Zanzibar. Near its banks geography lost one of her enthusiastic followers in the lamented Roscher: but his fate need not deter others, as with ordinary prudence it might have been averted. Unlike most African streams, the Rovuma opens without bar or surf to a spacious easily-entered bay. Previous to our visit only a few miles near its mouth were sufficiently known; native traders, however, always mentioned the river in its upper course as one of the chief features on the march from the shores of Nyassa to Zanzibar. With a view to ascertain something definite regarding its course, size, navigability, and value as a path to the interior, I accompanied Dr. Livingstone on two separate occasions. With the steam-vessel *Pioneer*, drawing 5 feet of water, we first attempted the ascent in March 1861. In common with other South Equatorial streams, the Rovuma was then in flood, and the large volume of water brought down extended into

the bay and covered its surface with weed and driftwood. So strong was the current then issuing from the mouth, that the vessel did not swing to the tide when anchored a quarter of a mile off in the bay. Everything at first seemed to indicate a large and fine river, but after an ascent of 30 miles, in which considerable difficulty was found in getting a navigable passage, it was thought advisable to retrace our steps lest a sudden fall of water should detain us until next season. On leaving the river fever attacked our crew, and for a time the *Pioneer* was in the hands of those who did not profess a knowledge of seamanship. We returned a second time to explore the Rovuma in the dry season of 1862, and with two of the ship's boats succeeded in reaching the rapids which limit navigation, distant from the coast a little more than 100 miles, and half-way to the Nyassa. On the 9th September, 1862, we left the *Pioneer* at anchor in the bay, and, accompanied for a short distance by Capt. Gardner, of H.M.S. *Orestes*, entered the river. A dark band of mangrove vegetation lines the creeks near the shore, over and beyond which, distant 8 miles, is a long, flat ridge, 200 feet high, broken only where the river enters the plain. Among the mangroves of a tropical coast there is little of interest: a death-like silence there prevails, broken only by the wild cry of the fish eagle or a startled antelope making off through the mud. Yet these desolate and gloomy forests accomplish a great work, growing where no other trees will, they favour the deposit of alluvial sediment and the extension of the land. When this unhealthy region is passed we enter a plain covered with heavy timber, thick bush, and gigantic grass, bound together and festooned by brilliant-flowered tropical plants, teeming with animal life. In the water there are herds of hippopotami, easy of approach, not having been hunted with fire-arms, but sufficiently bold to attack a boat with their formidable tusks. In the maritime region the tree which produced the copal still lingers on, but has died out from the inland district where the semi-fossil resin is dug from the soil.

The Rovuma, within the coast ridge, occupies a wide valley, whose wooded slopes, covered with jungle, are untouched by the hand of man. Having passed about 20 miles up the river, we came to a small lake in an amphitheatre off the northern slope. Here we saw the "tsetse" fly, which was afterwards found to be common near the river, and likely to prove a serious obstacle to the development of its resources. A comparison of the river in flood as seen by us on a former occasion with what it now was, showed that it did not receive any large supply from a distant lake, but consisted of the drainage of mountains. Instead of the channel being filled as then

with swiftly-flowing water, we now had a shallow stream winding from side to side between dry sandbanks and over shoals, where with difficulty our boats could pass. Direct progress was impossible, for every sandbank had to be gone round, thus lengthening the distance and doubling the labour; but our boat's crew consisted chiefly of Zambesi canoemen accustomed to judge where was the deepest water.

On the evening of the 16th we reached a village, near which we landed. This was the first of any consequence met with since entering the river. The natives were of the Makonde tribe, speaking a guttural and harsh language, which to us was almost unintelligible. The men had a forbidding expression of countenance, were poorly clothed, and went armed with the bow and arrow, a few only possessing fire-arms. The women were scarcely more attractive than their husbands, and dressed with only a sheet of bark, beaten soft to resemble cloth, wound round the loins. They adopt the lip-ring used by tribes near Lake Nyassa, which until now had not been seen among the men. Here for the first time we found a tall active fellow with his upper lip pierced, and a ring of ivory inserted. This is characteristic of the Mabiha, a small tribe in the hills to the south, between the Makonde of the Rovuma Valley and the Makoa of the coast. The sun at this season was very hot, and we felt it much, exposed as we were, without exercise, to its full influence in open boats. Sunstroke, however, in Africa is of rare occurrence. Throughout the afternoon the air in the shade was commonly at a temperature of 86° , and the river water varied from 80° to 90° .

On the 17th we came to natives dwelling in temporary grass huts, erected on a sandbank in the middle of the river, from which they would be driven by the first rise of water. It is difficult to understand why so many people should assemble here, if not for the purpose of plundering their neighbours. They were not fishermen, and their store of food seemed to be concealed in the forest. Their manner to us was rude and uncivil, as they crowded round the boats carrying arms in their hands. The presence in their village of two human heads did not render them more amiable, and we felt relieved after breakfast to be again in an uninhabited country. By night we came to another settlement, similar to that we had left, where we encamped for the night. On the sandbank we cooked supper, and pieces of coal were found washed from the strata above, showing the similarity of geological features between this and the Zambesi region. The river in front became excessively shallow and intricate, so that our progress was slow.

On the morning of the 19th, natives came from a village below as we got under way, with the ostensible object of selling tobacco;

their being well armed created in us no unusual alarm, as that seemed to be the custom of the country. These men, however, continued to follow us; and we had not advanced many miles when a rush was made to a commanding bank, near which we must pass, by about forty natives, who suddenly fired on the leading boat. Although arrows fell on all sides, no one was hurt, so we pulled out a little until the other boat advanced. The natives then professed to have attacked us from not understanding our motives in passing up the river; but the real cause was obviously plunder. After expressions of friendship, we again advanced; but when twenty yards off the bank, another shower of arrows fell about us, and the sail of the leading boat was pierced with five musket-balls. Had any of our party been accidentally killed, and the men thrown into confusion, we should have been immediately surrounded, and had to fight hand to hand against superior numbers. Those who had fired were now concealed, but two men appeared a little way down the bank, and by good luck our first shots telling well on them, we were allowed to pass the critical point unmolested. On our return we were treated with great respect in this part, nor will they be so ready to attempt the same on the next English who pass that way.

Next day we passed an uninhabited country, and came by evening to a settlement of Makoa, on the north bank of the river. Here we were well received, and obtained much information from an Arab trader, then on his way with slaves and ivory from Nyassa to the coast. The name of this place is Michi. Here caravans going to the coast leave the Rovuma, and avoid the people whom we had passed in the boat. The features of the country in front began to change: the hill slopes, which bound the valley, recede further off on both sides, and conical hills of eruptive trap appear for the first time—the general rock being stratified and highly crystalline schist, such as underlies the sandstone and coal on the Zambesi. While the finest trees were still without leaf, the large baobabs were bursting into flower, and thus anticipating the rains.

By the evening of the 25th, our boats had passed several miles of a dangerous rocky bed, and reached a point beyond which it was impossible to advance; for here a field of large boulders and rocks lies across the river, without leaving between them a passage sufficient for a boat. The town of N'gomano, where all caravans cross the Rovuma, was only two days' journey in front; but we could not leave our boats unguarded, although the people here were civil and respectful, laying down their arms on coming near us. The girls, too, from the opposite village came to see us,

handling their canoes with the greatest dexterity. At N'gomano the Rovuma is joined by a considerable affluent, the Niende, from the south-west, draining the eastern slope of the hills which bound the Nyassa, while the main river comes from the west or north-west. Although every one was acquainted with the Niende, few professed to have been on the Rovuma, but believed there were many rapids in its course, and that it came from Nyassa. The Niende is followed by caravans for several days when going to Nyassa, and in the first part of its course there are no rapids, but it is a shallow stream. For several days the path leads through an uninhabited country, and the first people met with after leaving N'gomano are the Ajawa, near the lake. After twelve days they reach the ferry at N'ombo, and there cross in canoes to Tsenga, on the western side of the Lake Nyassa. We returned to the ship after a month's absence, to find all well on board.

Although, as a path for commerce, the Rovuma is very inferior to the Shiré and Zambesi, being navigable only for a few months of the year, and stopping short half-way to the lake; yet in a region where water communication is scarce, it will serve to convey local produce, and in the mean time afford an excellent entrance by which to explore further the interesting regions between the Nyassa and Tanganyika lakes.

The PRESIDENT stated that the Rovuma was the entrance by which Dr. Livingstone, who had recently received the appointment of Consul to the independent chiefs of Central Africa and was about to start on his third journey of exploration, intended to penetrate the great unknown interior. He would endeavour to proceed up the north-western branch, which would enable him to pass all those obstacles offered by tribes nearer the coast connected with the slave traffic. His chief object in reaching the interior would be to solve the great problem of the watershed of Central Africa, by ascertaining the nature of the connexion (if any) between the great Lakes, which themselves are still very imperfectly known. Should it be the Doctor's good fortune to reach the northern end of Lake Tanganyika he would be able to determine the great question of the ultimate source of the Nile.

Dr. KIRK said there was no doubt that, for a route for trade and commerce into the interior of Africa, the path of the Zambesi and the Shiré is the best. Unfortunately, however, that route is not open, the Portuguese not allowing any trader of a foreign nation to go that way. In the mean time the path that Dr. Livingstone is to follow promises very good results; in fact, as a mere exploring path for a small party it is perhaps equal to the Zambesi, although not at all capable of carrying on large expeditions with boats. By way of the Shiré, it would be an easy thing to take a large boat up and launch it on Lake Nyassa. He thought, however, all that was necessary for settling the sources of the great rivers could be easily accomplished by way of the Rovuma.
